Preliminary

CBC-EVAL-12-34123

EnerChip™ RTC Evaluation Kit

Real-Time Clock with Integrated Backup Power

System Features and Overview

CBC-EVAL-12-34123 is a demonstration kit featuring the Cymbet CBC34123 EnerChip RTC - an integrated surface mount device combining an NXP PCF2123 Real-Time Clock (RTC), power management circuit, and solid state rechargeable EnerChip providing 30 hours of backup power to the RTC.

The kit demonstrates just how compact an RTC with integrated backup power can be using the low profile surface mount device from Cymbet. The combined solution occupies **only 0.25 cm²** of board space.

CBC-EVAL-12-34123 has the following elements:

- Low power RTC with SPI-interface bus
- Solid state rechargeable energy storage for real-time clock backup power
- Power fail detect with automatic switchover from main power to integrated backup power source
- Integrated battery management that controls battery charging and discharge cutoff, ensuring maximum service life of the on-board storage cell
- USB connector for easy demonstration and application development on personal computer
- Input/output access to board for easy connection to external microcontroller

Smallest RTC Power Backup Footprint

The block diagram of Figure 1 illustrates the CBC-EVAL-12-34123, an extremely compact low power RTC with integrated backup power source.

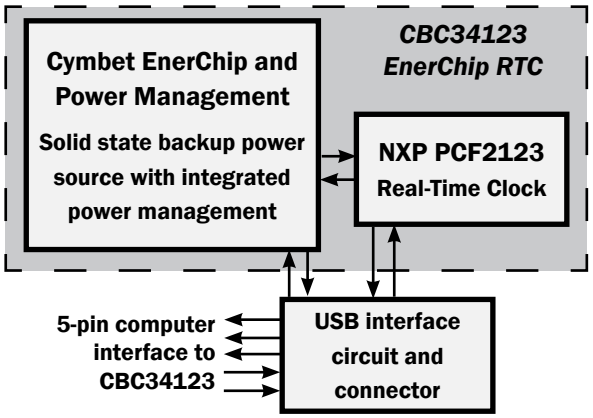

Cymbet EnerChip and Power Management
Solid state backup power source with integrated power management
CBC34123 EnerChip RTC
NXP PCF2123 Real-Time Clock
5-pin computer interface to CBC34123
USB interface circuit and connector

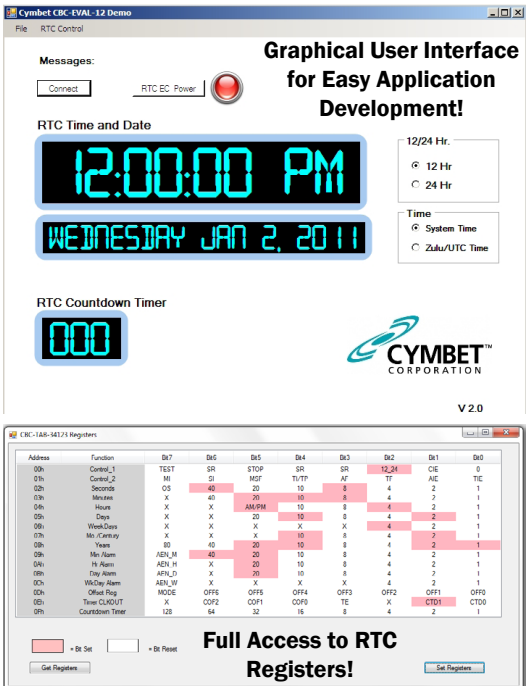
Figure 1: CBC-EVAL-12-34123 Block Diagram.

Figure 2 shows the USB Interface Board to the left, and the CBC34123 EnerChip RTC Tab Board to the right.

Figure 2: CBC-EVAL-12-34123 Demo Kit.

EVAL-12 Graphical User Interface

The CBC-EVAL-12-34123 includes a PC-based software application that communicates with the USB stick. Users can set the time of day, date, and countdown timer values to experiment with RTC power-back-up. The application also allows the user access to the RTC registers for viewing and modification. The software works with Microsoft Windows XP, Windows 7, and Windows 8 operating systems. Once the EVAL-12 USB stick is inserted into the PC, the Connect button is clicked in the GUI to establish communication over the USB port. The entire USB stick or just the CBC34123 Tab Board can then be removed from the PC and the RTC will be powered by the EnerChip rechargeable solid state battery that is integrated within the CBC34123 5mm x 5mm QFN package on the CBC34123 Tab Board.



CBC-EVAL-12 Module Connector, Jumpers, and Test Points

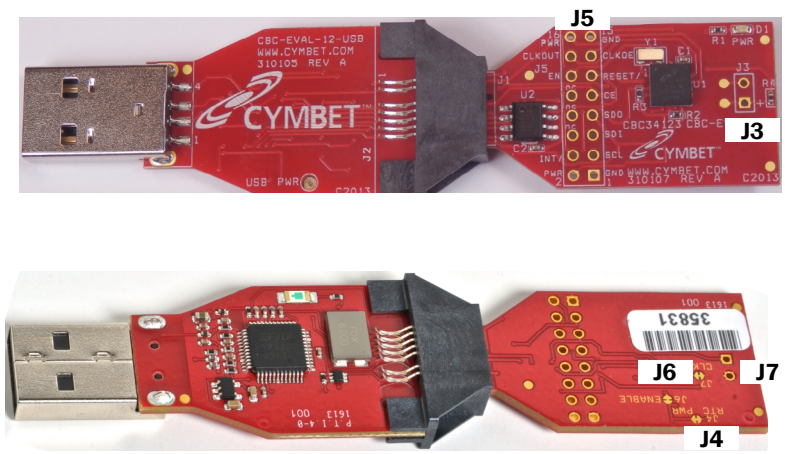


Figure 3: Locations of Jumpers.

JUMPERS AND CONNECTORS		
Jumper	**Pin Number**	**Designation**
J3	1	EXT ENERCHIP (+)
	2	EXT ENERCHIP (-)
J4	PCB Trace	RTC PWR - Cut jumper to disable RTC 'PWR' LED
J5	1	GND
	2	POWER
	3	SPI-SCL
	4	INT/
	5	SPI-SDI
	6	NC
	7	SPI-SDO
	8	NC
	9	SPI-CE
	10	NC
	11	RESET/
	12	EN
	13	CLKOE
	14	CLKOUT
	15	GND
	16	POWER
J6	PCB Trace	ENABLE - Cut jumper to enable/disable the CBC34123 charge pump
J7	PCB Trace	CLKOE - Cut jumper and tie J5-P13 high (to RTC PWR, J5-P2 or J5-P16) to enable clock output signal on J5-P14

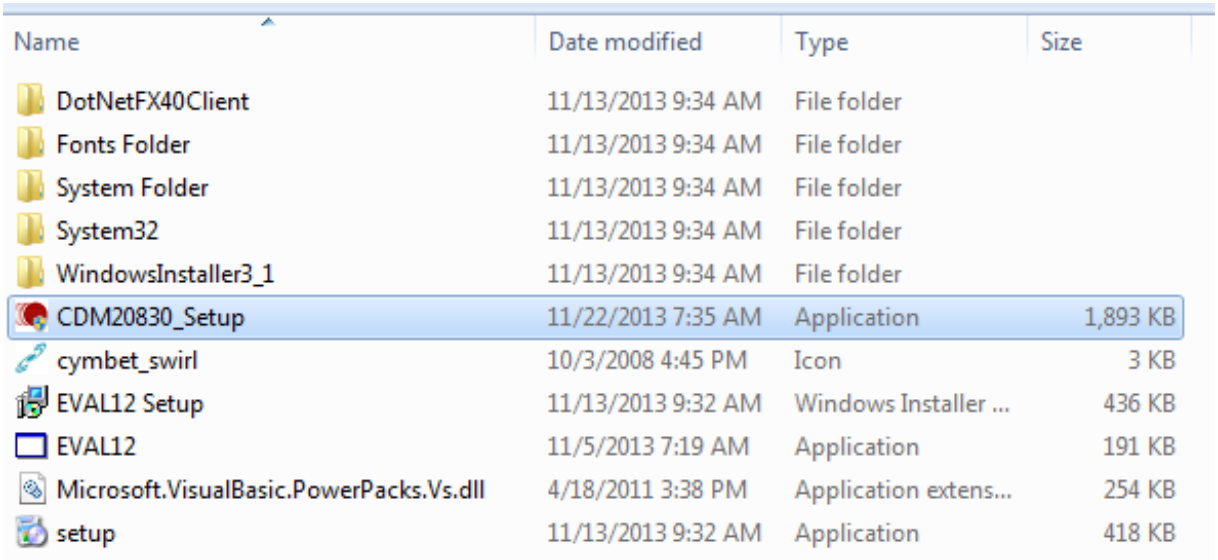
Getting Started

BEFORE inserting the USB dongle into the USB port, proceed with the file downloads as described below.

For first time users who have not installed the demonstration software, follow these steps:

1. Download the CBC-EVAL-12-34123 files from the web site and save them to your computer:

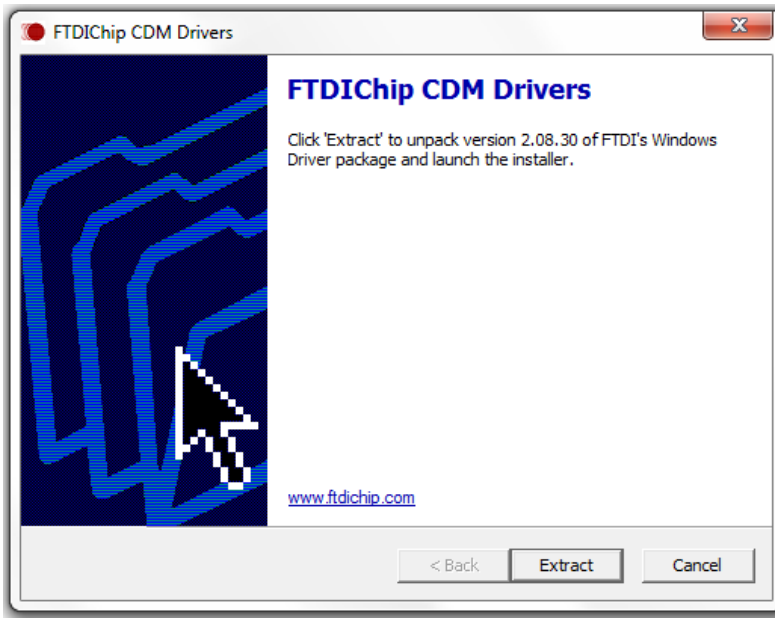
The directory structure loaded to your computer will look like the following:


Name
Date modified
Type
Size
DotNetFX40Client 11/13/2013 9:34 AM File folder
Fonts Folder 11/13/2013 9:34 AM File folder
System Folder 11/13/2013 9:34 AM File folder
System32 11/13/2013 9:34 AM File folder
WindowsInstaller3_1 11/13/2013 9:34 AM File folder
CDM20830_Setup 11/22/2013 7:35 AM Application 1,893 KB
cymbet_swirl 10/3/2008 4:45 PM Icon 3 KB
EVAL12 Setup 11/13/2013 9:32 AM Windows Installer ... 436 KB
EVAL12 11/5/2013 7:19 AM Application 191 KB
Microsoft.VisualBasic.PowerPacks.Vs.dll 4/18/2011 3:38 PM Application extens... 254 KB
setup 11/13/2013 9:32 AM Application 418 KB

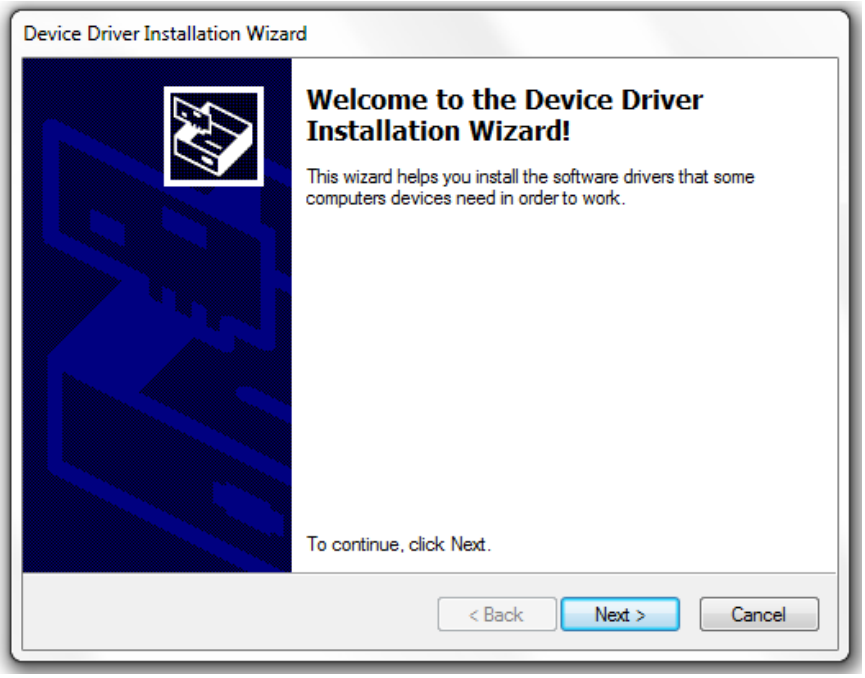
2. Do not yet insert any hardware into the USB port. Launch the application by clicking on CDM20830_Setup.

3. A dialog box will appear, asking: “Do you want to allow the following program to make changes to this computer?” Click the ‘Yes’ option.

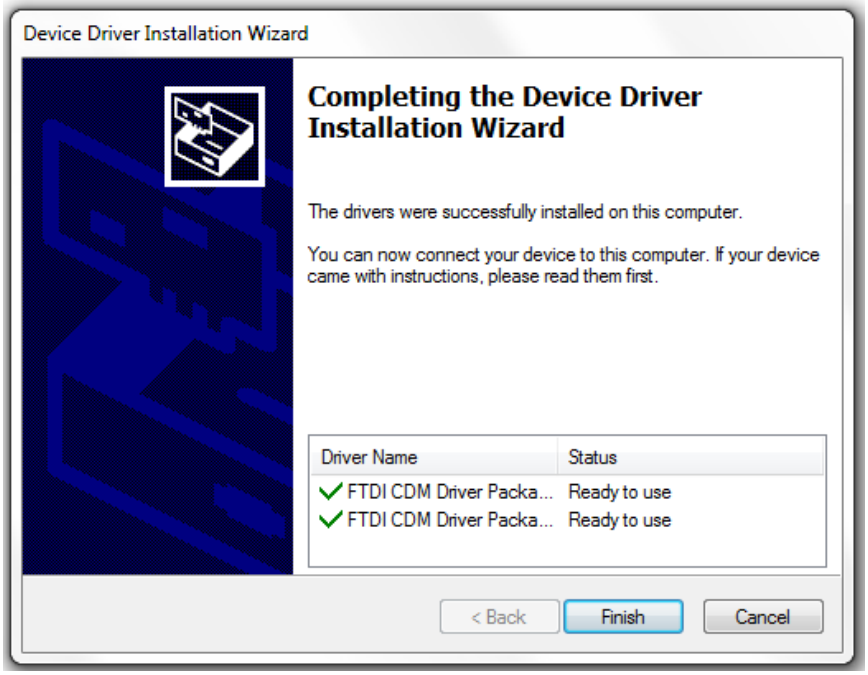
4. The following window will appear. Click ‘Extract.’



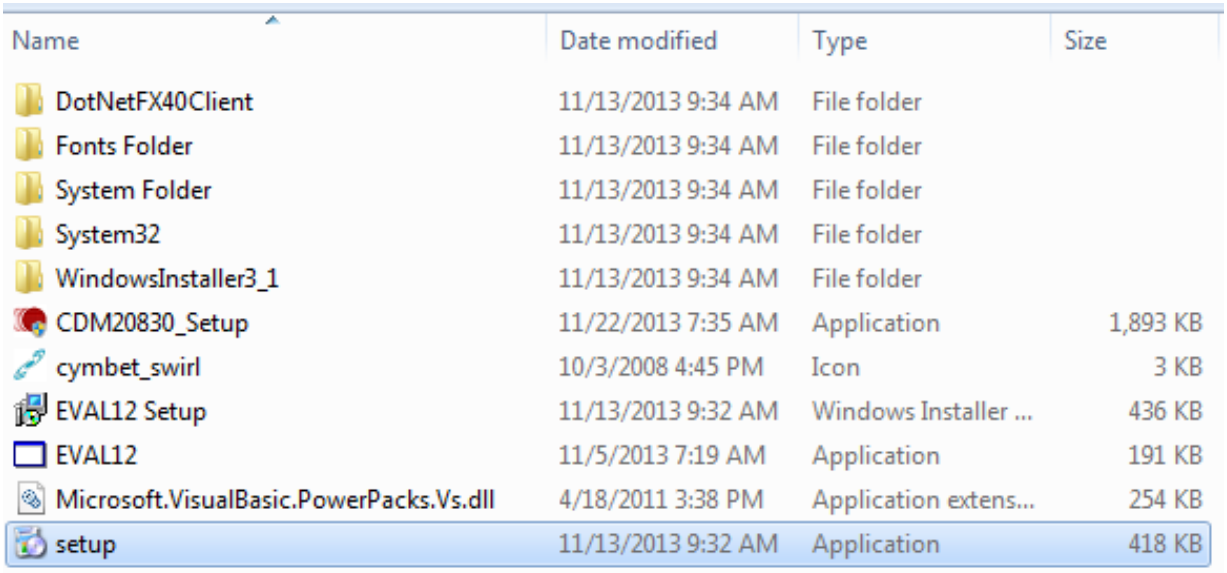
5. When the following window appears click 'Next.'


Device Driver Installation Wizard
Welcome to the Device Driver Installation Wizard!
This wizard helps you install the software drivers that some computers devices need in order to work.
To continue, click Next.
< Back
Next >
Cancel

6. Once the files have loaded, the following window will appear. Click 'Finish.' This installs the files pertaining to the USB interface.


Device Driver Installation Wizard
Completing the Device Driver Installation Wizard
The drivers were successfully installed on this computer.
You can now connect your device to this computer. If your device came with instructions, please read them first.
Driver Name
Status
FTDI CDM Driver Packa...
Ready to use
FTDI CDM Driver Packa...
Ready to use
< Back
Finish
Cancel

7. Next, launch the application by opening the setup file - as highlighted in the following diagram - located in the directory.


Name
Date modified
Type
Size
DotNetFX40Client 11/13/2013 9:34 AM File folder
Fonts Folder 11/13/2013 9:34 AM File folder
System Folder 11/13/2013 9:34 AM File folder
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CDM20830_Setup 11/22/2013 7:35 AM Application 1,893 KB
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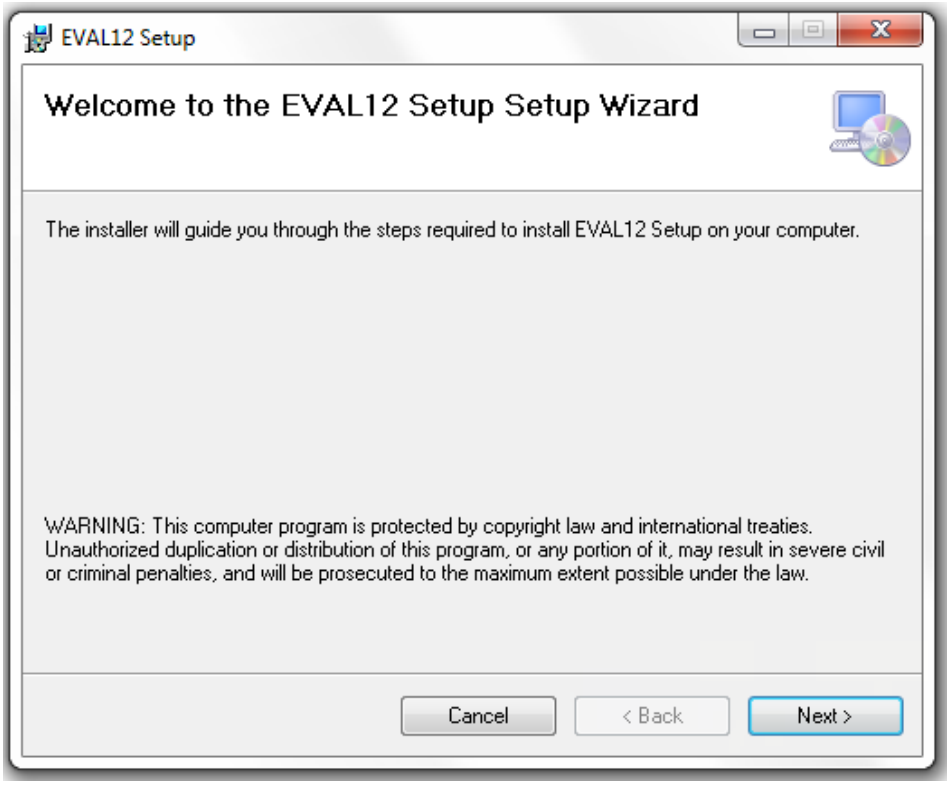
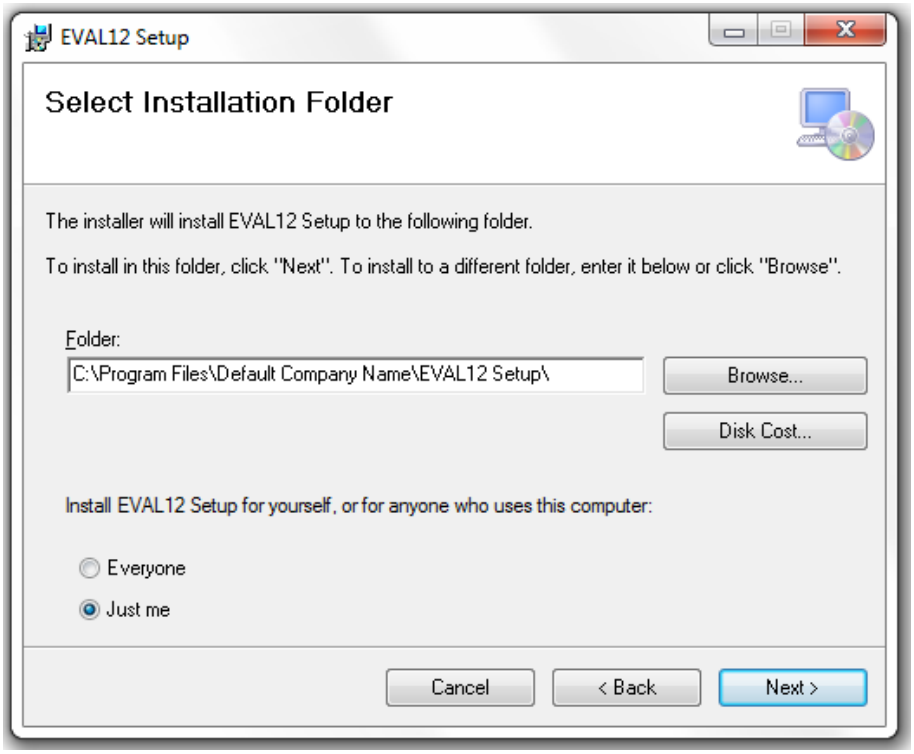
EVAL12 Setup 11/13/2013 9:32 AM Windows Installer ... 436 KB
EVAL12 11/5/2013 7:19 AM Application 191 KB
Microsoft.VisualBasic.PowerPacks.Vs.dll 4/18/2011 3:38 PM Application extens... 254 KB
setup 11/13/2013 9:32 AM Application 418 KB

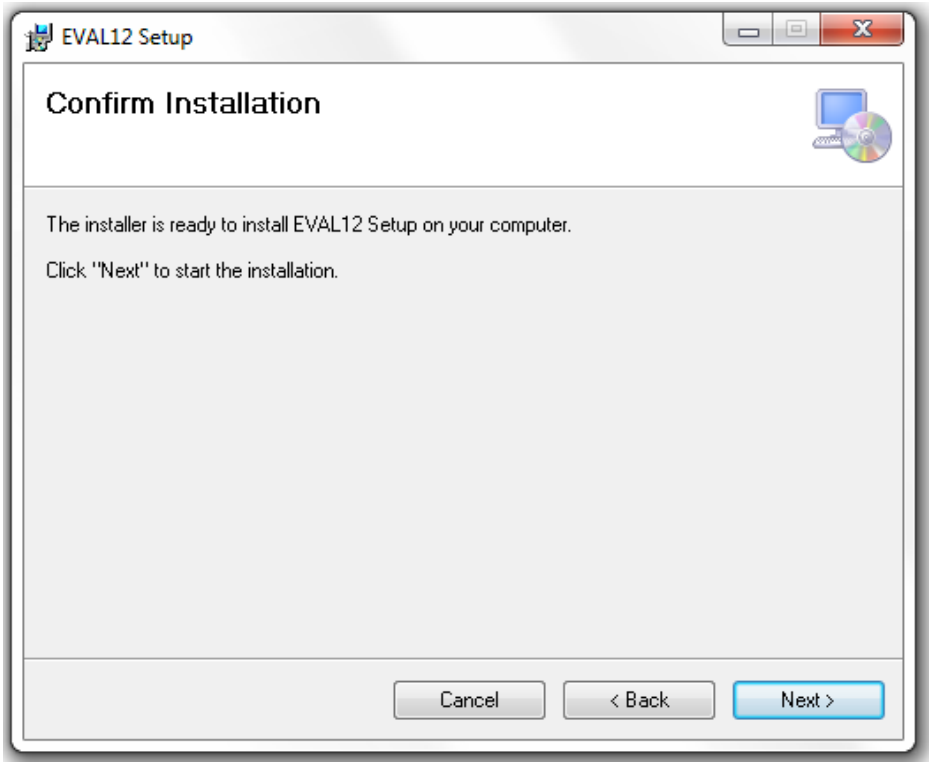
8. When the following window appears, click 'Next.'


EVAL12 Setup
Welcome to the EVAL12 Setup Setup Wizard
The installer will guide you through the steps required to install EVAL12 Setup on your computer.
WARNING: This computer program is protected by copyright law and international treaties. Unauthorized duplication or distribution of this program, or any portion of it, may result in severe civil or criminal penalties, and will be prosecuted to the maximum extent possible under the law.
Cancel
< Back
Next >

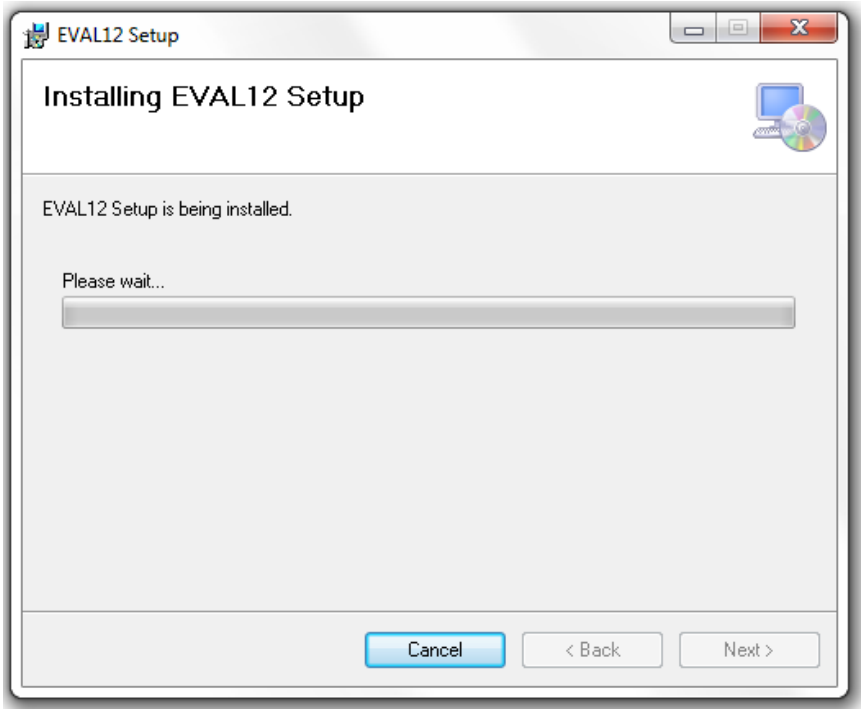
9. When the following window appears, select an installation folder destination on your computer and click 'Next.'


EVAL12 Setup
Select Installation Folder
The installer will install EVAL12 Setup to the following folder.
To install in this folder, click "Next". To install to a different folder, enter it below or click "Browse".
Folder:
C:\Program Files\Default Company Name\EVAL12 Setup\
Browse...
Disk Cost...
Install EVAL12 Setup for yourself, or for anyone who uses this computer:
Everyone
Just me
Cancel
< Back
Next >

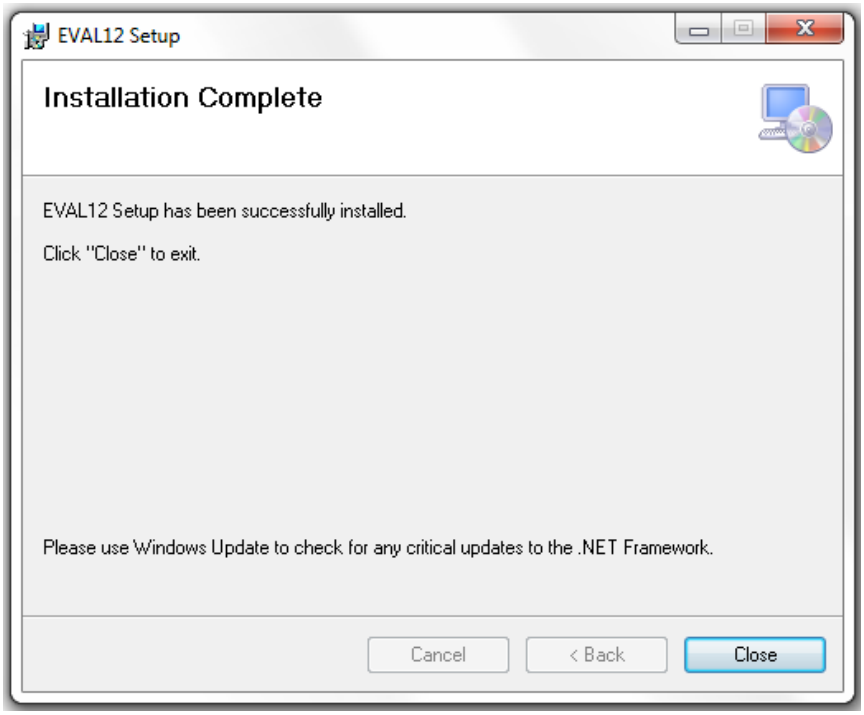
10. The following window will appear. Again, click 'Next.'


EVAL12 Setup
Confirm Installation
The installer is ready to install EVAL12 Setup on your computer.
Click "Next" to start the installation.
Cancel
< Back
Next >

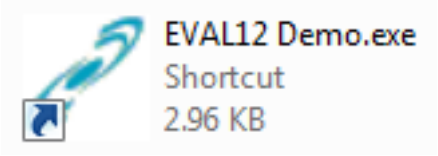
11. The following window will appear. Allow the installation to continue and when the message “Do you want to allow the following program from an unknown publisher to make changes to this computer?” appears, answer ‘Yes.’



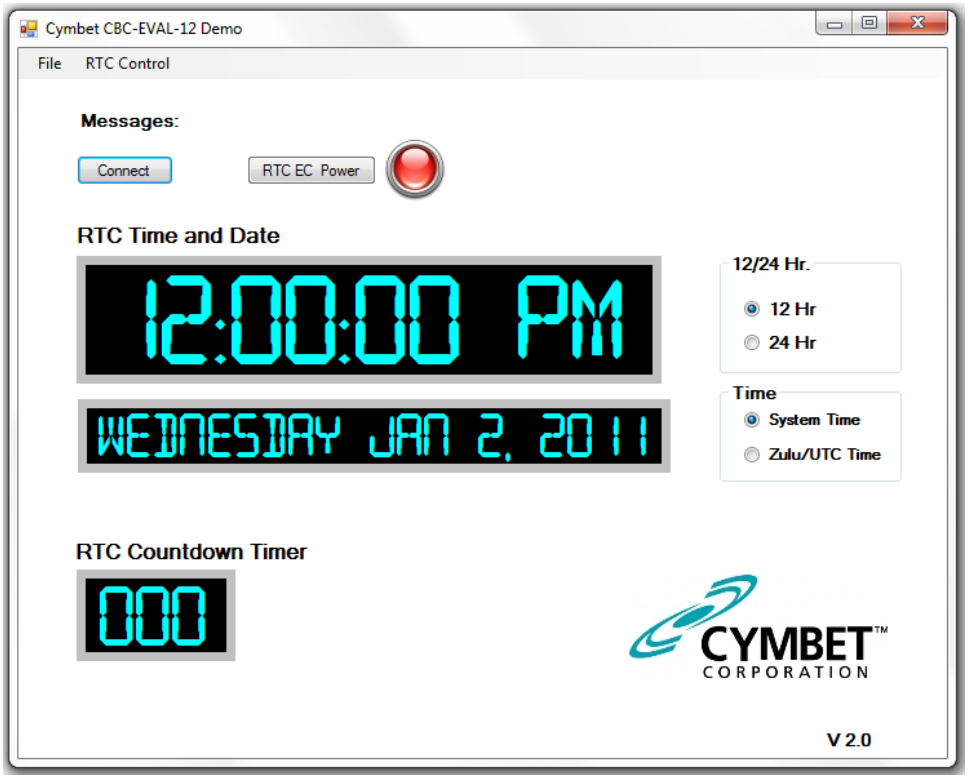
12. Once the installation is complete, the following window will appear. Click ‘Close.’


EVAL12 Setup
Installation Complete
EVAL12 Setup has been successfully installed.
Click "Close" to exit.
Please use Windows Update to check for any critical updates to the .NET Framework.
Cancel
< Back
Close

13. There should now be an EVAL12 Demo Shortcut icon on your desktop, as shown below. Double-click on the icon to launch the Graphical User Interface (GUI).

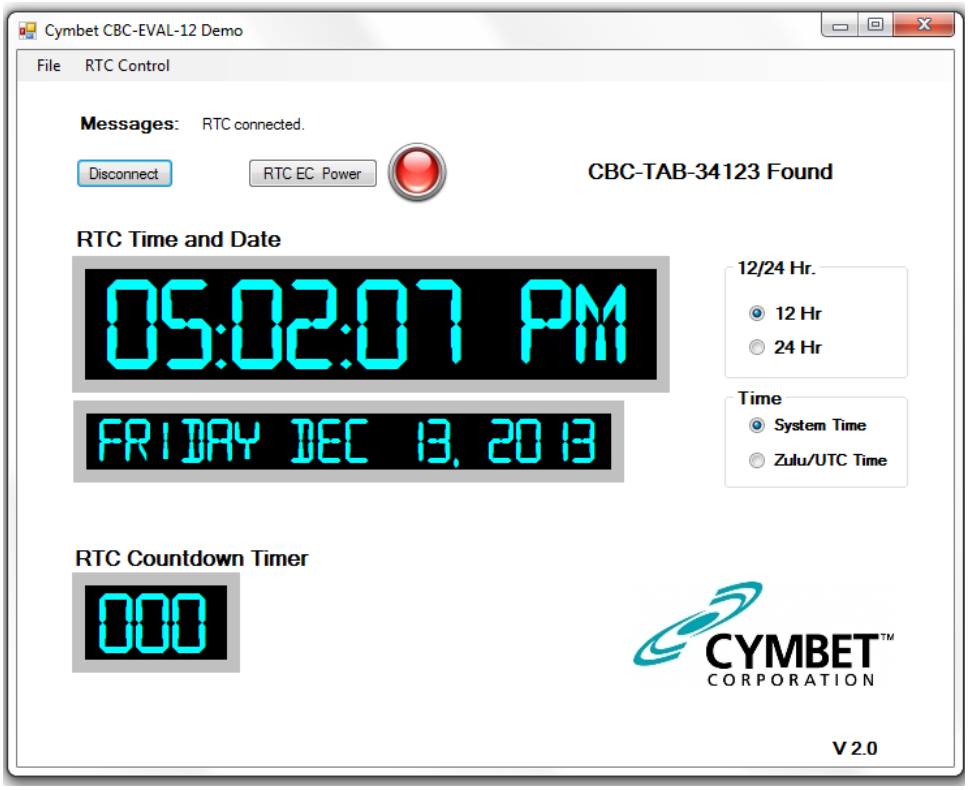


GUI installation is now complete. The following window should appear.



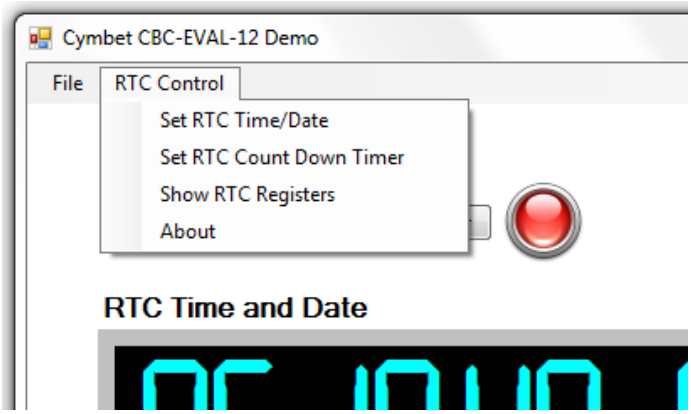
14. Insert the CBC-EVAL-12-34123 dongle into the USB port. It can take up to a minute for the computer to recognize the new hardware.

15. Both red LEDs on the EVAL stick - one on the USB board and the other on the Tab Board - should be lit. Click the 'Connect' button on the GUI. The computer's system time should now appear active in the GUI. At the top right of the window, 'CBC-TAB-34123 Found' is indicated, along with 'Messages: RTC Connected' at the top left.

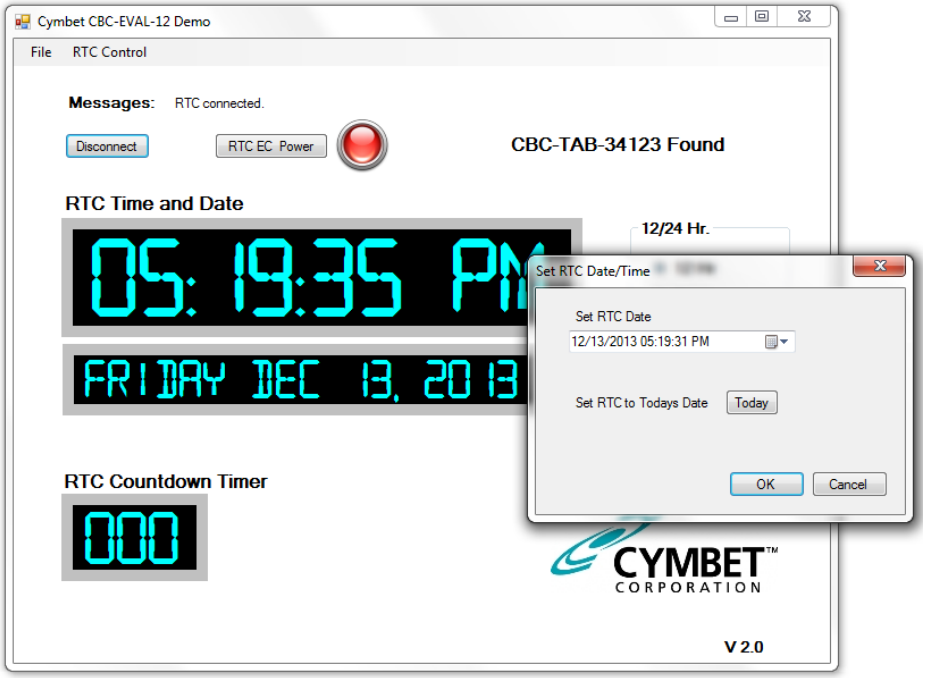


16. Click ‘RTC EC Power’ to disable power from the dongle. The ‘RTC EC Power’ indicator on the GUI will turn off, as will the ‘PWR’ LED on the CBC34123 Tab Board. Click ‘RTC EC Power’ to again apply power to the dongle.

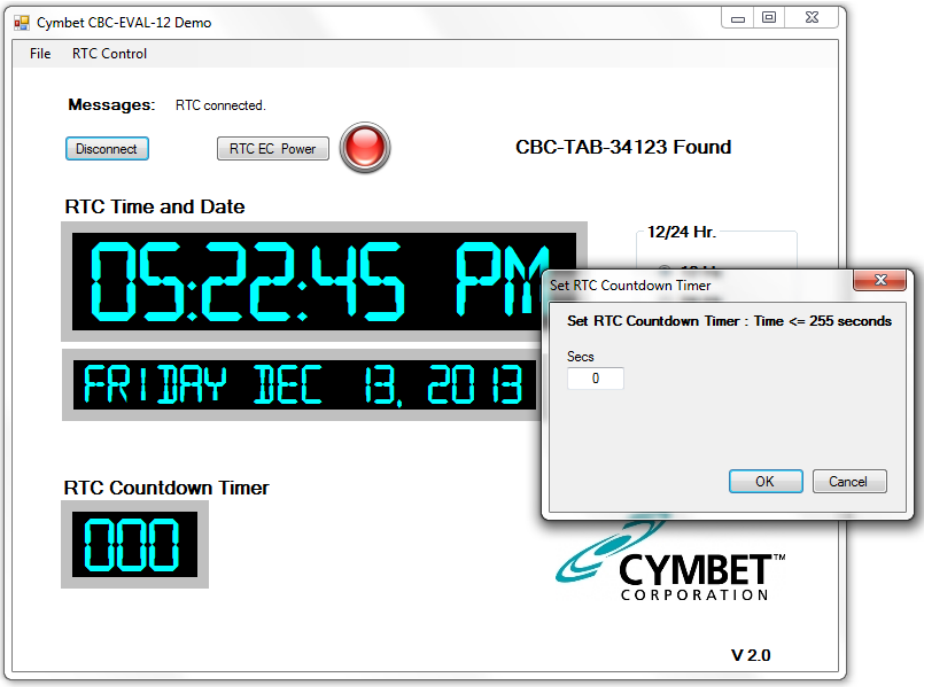
17. There are several configuration options available to the user from the ‘RTC Control’ menu. To view the available options, open the ‘RTC Control’ drop-down menu and select from the 3 options as shown below.



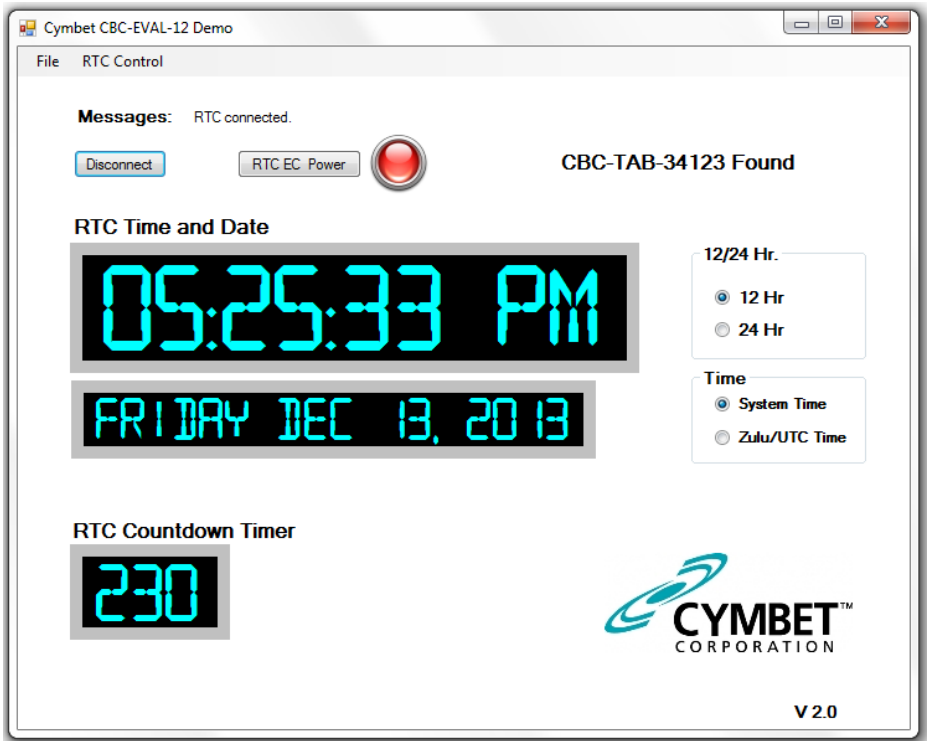
18. The 'Set RTC Date/Time' option allows the user to set a specific date and time. Enter any arbitrary date and time as the starting time, using either the drop-down calendar menu, or by manually entering the data. Click 'OK' to execute the command.



The 'RTC Count Down Timer' option allows the user to apply a value from 0 to 255 in 'Secs' field.



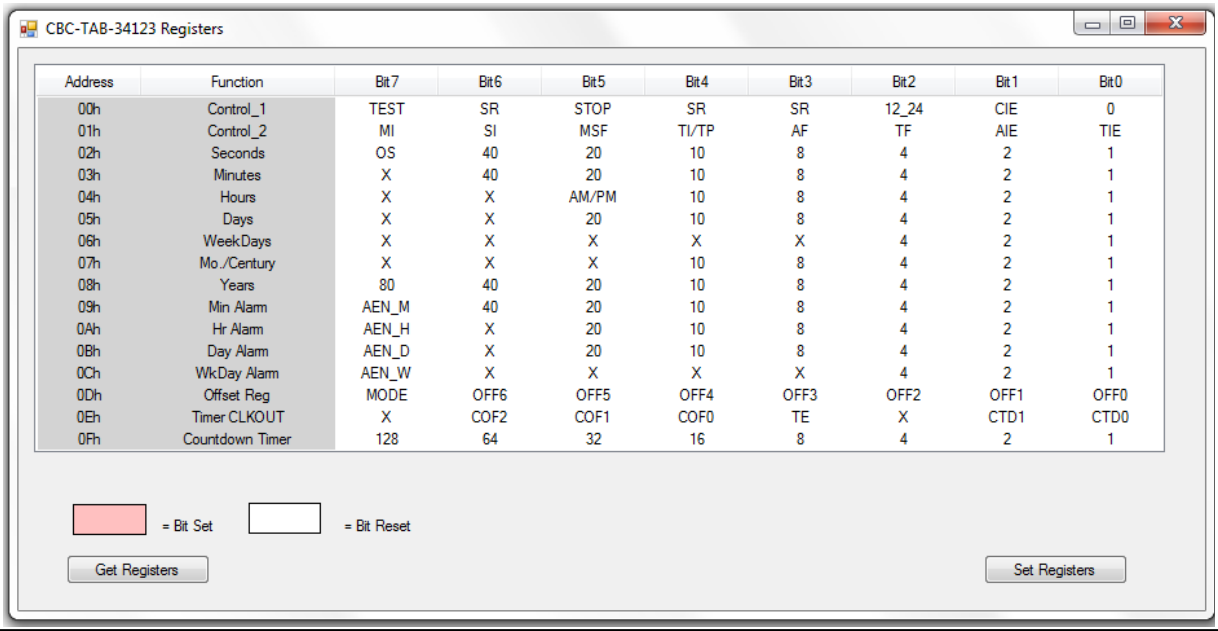
19. Enter a valid number and click 'OK' to execute the command. The timer will then be set and begin to count down to zero.



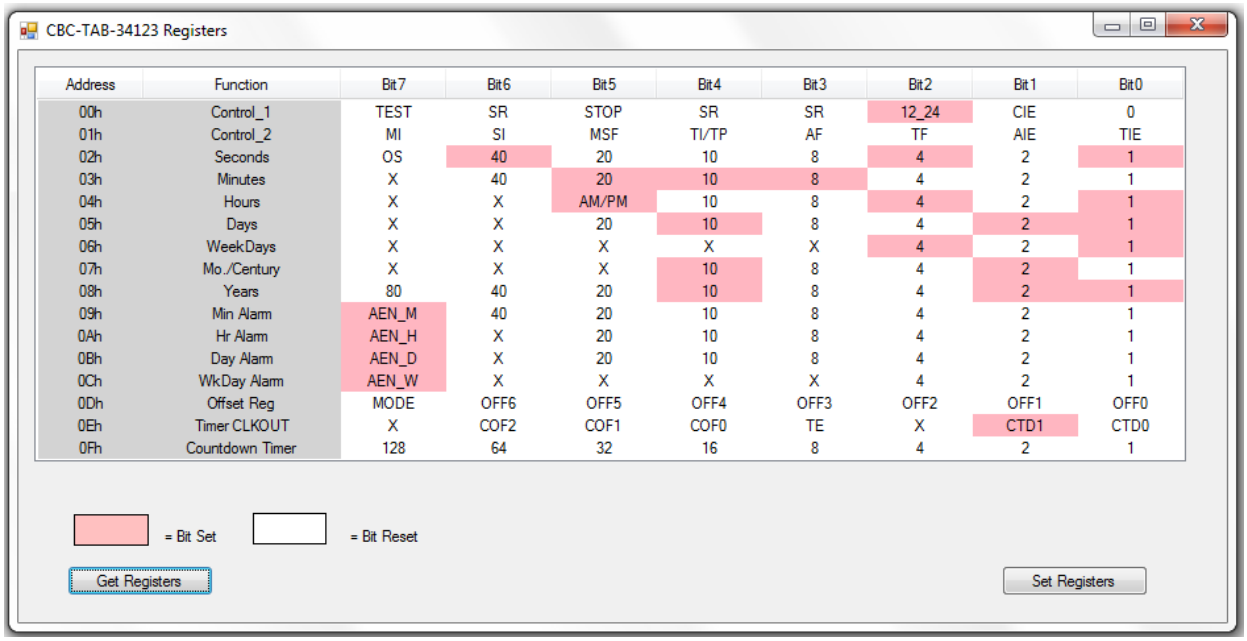
20. The system set-up is now complete. Once the countdown timer or date and time have been set, the integrated EnerChip battery can be used to maintain the timer or real time by either disabling power from the dongle by clicking the 'RTC EC Power' button or removing the dongle from the USB port. In the absence of USB power, the EnerChip will provide power to the PCF2123 RTC for up to 30 hours. Simply re-insert the dongle or re-apply power to verify that the countdown timer or time and date were maintained while the dongle was not under USB power.

RTC Register Access

The PCF2123 registers are also accessible through the EVAL-12 GUI. Select the 'Show RTC Registers' option to view and modify the RTC register settings as shown below.

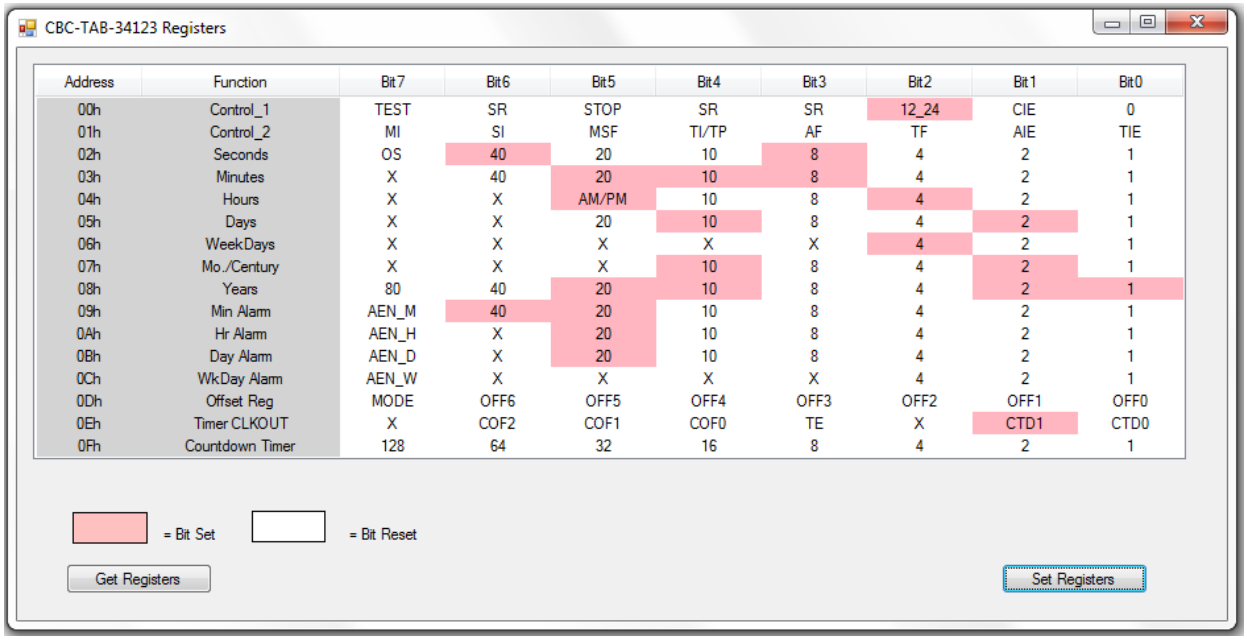

CBC-TAB-34123 Registers
Address
Function
Bit7
Bit6
Bit5
Bit4
Bit3
Bit2
Bit1
Bit0
00h Control_1 TEST SR STOP SR SR 12_24 CIE 0
01h Control_2 MI SI MSF TI/TP AF TF AIE TIE
02h Seconds OS 40 20 10 8 4 2 1
03h Minutes X 40 20 10 8 4 2 1
04h Hours X X AM/PM 10 8 4 2 1
05h Days X X 20 10 8 4 2 1
06h WeekDays X X X X X 4 2 1
07h Mo./Century X X X 10 8 4 2 1
08h Years 80 40 20 10 8 4 2 1
09h Min Alarm AEN_M 40 20 10 8 4 2 1
0Ah Hr Alarm AEN_H X 20 10 8 4 2 1
0Bh Day Alarm AEN_D X 20 10 8 4 2 1
0Ch WkDay Alarm AEN_W X X X X 4 2 1
0Dh Offset Reg MODE OFF6 OFF5 OFF4 OFF3 OFF2 OFF1 OFF0
0Eh Timer CLKOUT X COF2 COF1 COF0 TE X CTD1 CTD0
0Fh Countdown Timer 128 64 32 16 8 4 2 1
= Bit Set
= Bit Reset
Get Registers
Set Registers

From this window, click on the 'Get Registers' box to reveal the bit settings. An example of the register map is shown in the following window.



Address	Function	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00h	Control_1	TEST	SR	STOP	SR	SR	12_24	CIE	0
01h	Control_2	MI	SI	MSF	TI/TP	AF	TF	AIE	TIE
02h	Seconds	OS	40	20	10	8	4	2	1
03h	Minutes	X	40	20	10	8	4	2	1
04h	Hours	X	X	AM/PM	10	8	4	2	1
05h	Days	X	X	20	10	8	4	2	1
06h	WeekDays	X	X	X	X	X	4	2	1
07h	Mo./Century	X	X	X	10	8	4	2	1
08h	Years	80	40	20	10	8	4	2	1
09h	Min Alarm	AEN_M	40	20	10	8	4	2	1
0Ah	Hr Alarm	AEN_H	X	20	10	8	4	2	1
0Bh	Day Alarm	AEN_D	X	20	10	8	4	2	1
0Ch	WkDay Alarm	AEN_W	X	X	X	X	4	2	1
0Dh	Offset Reg	MODE	OFF6	OFF5	OFF4	OFF3	OFF2	OFF1	OFF0
0Eh	Timer CLKOUT	X	COF2	COF1	COF0	TE	X	CTD1	CTD0
0Fh	Countdown Timer	128	64	32	16	8	4	2	1

To adjust the registers, click on either the 'Bit Set' or 'Bit Reset' box in the lower left corner of the register map, window then click on the field in one of the 'Bit' columns to set or reset, respectively, that register bit. When finished setting the register fields, click the 'Set Register' button in the lower right corner of the window.



Address	Function	Bit7	Bit6	Bit5	Bit4	Bit3	Bit2	Bit1	Bit0
00h	Control_1	TEST	SR	STOP	SR	SR	12_24	CIE	0
01h	Control_2	MI	SI	MSF	TI/TP	AF	TF	AIE	TIE
02h	Seconds	OS	40	20	10	8	4	2	1
03h	Minutes	X	40	20	10	8	4	2	1
04h	Hours	X	X	AM/PM	10	8	4	2	1
05h	Days	X	X	20	10	8	4	2	1
06h	WeekDays	X	X	X	X	X	4	2	1
07h	Mo./Century	X	X	X	10	8	4	2	1
08h	Years	80	40	20	10	8	4	2	1
09h	Min Alarm	AEN_M	40	20	10	8	4	2	1
0Ah	Hr Alarm	AEN_H	X	20	10	8	4	2	1
0Bh	Day Alarm	AEN_D	X	20	10	8	4	2	1
0Ch	WkDay Alarm	AEN_W	X	X	X	X	4	2	1
0Dh	Offset Reg	MODE	OFF6	OFF5	OFF4	OFF3	OFF2	OFF1	OFF0
0Eh	Timer CLKOUT	X	COF2	COF1	COF0	TE	X	CTD1	CTD0
0Fh	Countdown Timer	128	64	32	16	8	4	2	1

When finished using the CBC-EVAL-12-34123, click the 'RTC EC Power' button in the main GUI window to turn off power to the module. Then click on the 'Disconnect' button and remove the USB dongle from the computer.

Reference Documents

CBC34123 EnerChip RTC Data Sheet: http://www.cymbet.com/pdfs/DS-72-31.pdf .

PCF2123 NXP Real-Time Clock Data Sheet: http://www.nxp.com/documents/data_sheet/PCF2123.pdf .

Crystal Selection Guide: UM10301 - User Manual for NXP Real Time Clocks:
http://www.nxp.com/documents/user_manual/UM10301.pdf .

CBC-EVAL-12-34123 Circuit Schematic

The schematic of Figure 4 depicts the CBC-EVAL-12-34123 RTC board. For the purpose of supporting hardware development, CBC34123 package pins are accessible by way of through-hole vias 1-16 of J5 on the Tab Board. Additional backup run time is supported by connecting external EnerChips to the CBC34123 by way of through-hole vias 1-2 of J3.

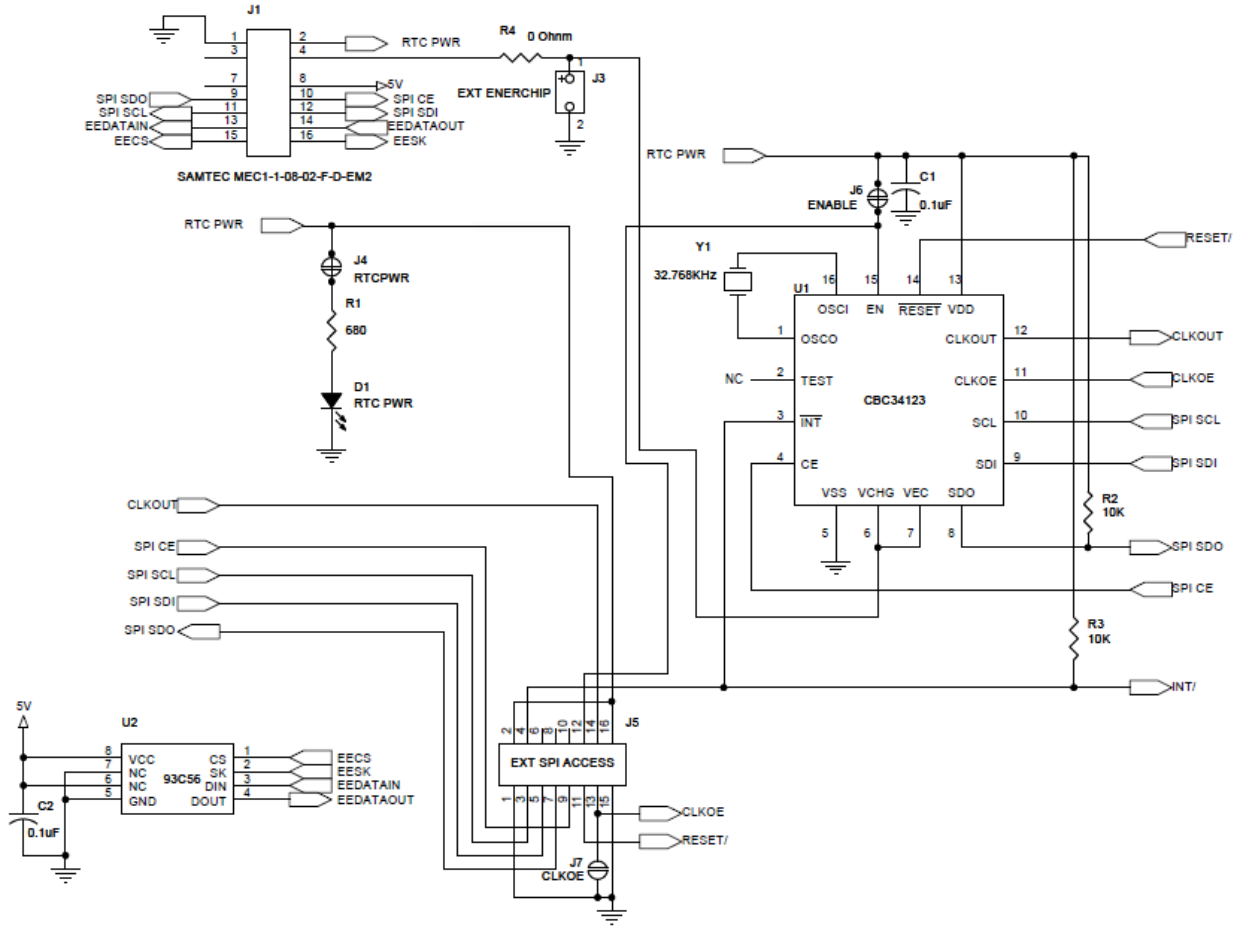


Figure 4: CBC-EVAL-12-34123 EnerChip RTC Board Circuit Schematic.

Table 1: CBC-EVAL-12-34123 EnerChip RTC Board Bill of Materials.

Quantity	Ref. Designator	Manufacturer	Manufacturer Part #	Description	Distributor	Distributor Part #
1	R4	Stackpole Electronics Inc	RMCF0402ZT0R00	RES 0.0 OHM 1/16W JUMP 0402	DIGI-KEY	RMCF0402ZT0R00CT-ND
1	R1	Yageo	RC0402JR-07680RL	RES 680 OHM 1/16W 5% 0402 SMD	DIGI-KEY	311-680JRCT-ND
2	R2, R3	Vishay/Dale	CRCW040210K0FKED	RES 10.0K OHM 1/16W 1% 0402 SMD	DIGI-KEY	541-10.0KLCT-ND
2	C1, C2	Taiyo Yuden	LMK105BJ104KV-F	CAP CER 0.1UF 10V 10% X5R 0402	DIGI-KEY	587-1227-1-ND
1	D1	Lumex Opto/Components Inc	SML-LX0603IW-TR	LED 635NM RED DIFF 0603 SMD	DIGI-KEY	67-1548-1-ND
1	U1	Cymbet	CBC34123	RTC clock module with SPI interface	CYMBET	
1	U2	ON Semiconductor	CAT93C56VI-GT3	EEPROMs - Serial 256 X 8	DIGI-KEY	CAT93C56VI-GT3OSCT-ND
1	Y1	Micro Crystal Switzerland	CM7V-T1A	CRYSTAL 32.768KHz 9PF SMT		
1	PCB1	Cymbet	310107 REV A	PRINTED CIRCUIT BOARD	CYMBET	N/A
1	LABEL			SERIAL NUMBER LABEL - BAR CODE		

CBC-EVAL-12-34123 Assembly Diagrams

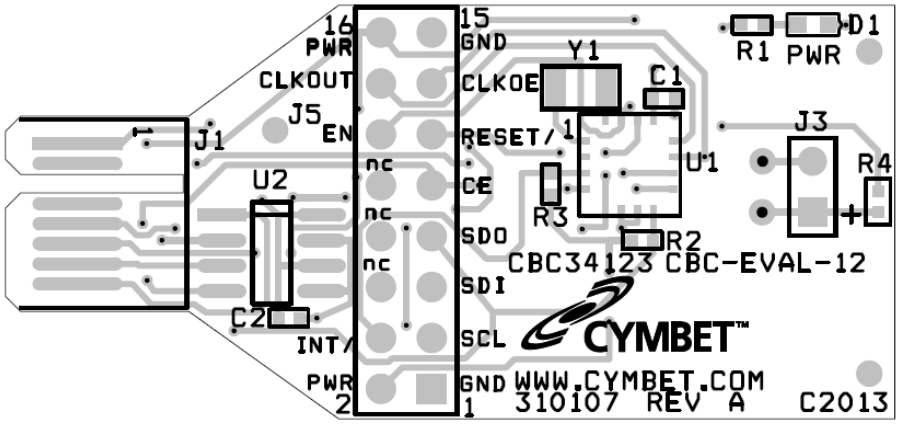


Figure 5: CBC-EVAL-12-34123 EnerChip RTC Board Assembly Diagram (Top View).

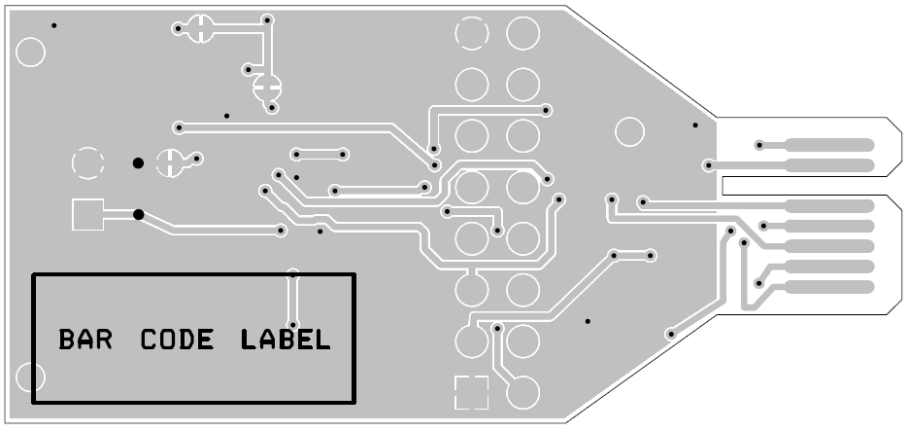


Figure 6: CBC-EVAL-12-34123 EnerChip RTC Board Assembly Diagram (Bottom View).

Ordering Information

EnerChip Part Number	Description	Notes
CBC34123-M5C	EnerChip RTC SPI 5uAh 2123 5x5 QFN -20-70C	Tube
CBC-EVAL-12-34123	EnerChip RTC CBC34123 Evaluation Kit USB and RTC Tab Board	
CBC-TAB-34123	EnerChip EVAL-12 CBC34123 Tab Board	

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